PORSF 2.1.1 v.4
6/8/2007

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
OREGON OPERATIONS OFFICE
811 S.W. 6th Avenue
Portland, Oregon 97204

June 8, 2007

Mr. Jim McKenna
Port of Portland & Co-Chairman, Lower Willamette Group
121 NW Everett
Portland, Oregon 97209

Mr. Robert Wyatt
Northwest Natural & Co-Chairman, Lower Willamette Group
220 Northwest Second Avenue
Portland, Oregon 97209

Re: Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240. Round 3B Data Gaps

Dear Messrs. Wyatt and McKenna:

The purpose of this letter is to document the data that EPA has determined is necessary to complete the Portland Harbor Remedial Investigation and Feasibility Study RI/FS. Data gaps were identified through consideration of the following documents and supporting information:

- Identification of Round 3 Data Gaps Memorandum, prepared by EPA, dated December 2, 2005.
- Round 3 Scope of Work, prepared by EPA, dated February 17, 2006.
- Agreements reached regarding Round 3A and Round 3B data gaps as agreed to on May 23, 2006 and documented in EPA's Issue Summary Table dated August 24, 2006 and the LWG's response to the Issue Summary Table dated October 19, 2006
- The Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report, prepared by the LWG, dated February 21, 2007.

The data gaps identified herein should be considered EPA comments on the data gaps analysis of the Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report. Additional comments on the data evaluation and assessment presented in the Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report will be provided at a later date. In addition, these data gaps should also be considered preliminary comments on the three field sampling plans recently submitted by the LWG.

what about feasibility?

EPA would like to acknowledge the extensive amount of sediment, tissue, surface water, transition zone water, and other data types that has been collected during the course of the Portland Harbor RI/FS and presented in the Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report. EPA believes that the data needs outlined herein will allow us to complete the characterization phase of the RI/FS and move forward with remedy selection by the end of 2010. A summary of the data needs are presented in Table 1. EPA and the LWG will need to prioritize these data needs in order to complete data collection activities by the end of 2007 or early 2008 at the latest. For example, transition zone water sampling and biota tissue should be considered the highest priority due to the seasonal nature of these data collection activities while sediment chemistry and toxicity testing should be considered a lower priority because they may be collected at virtually any time.

EPA has divided data needs into six categories. Each category is described below. Supporting information is provided as attachments to this letter.

Evaluation of Benthic Risk and Lateral Extent of Contamination: EPA has evaluated three lines of evidence for evaluating risks to the benthic community: Empirical measures of sediment toxicity, the Floating Percentile Method for predicting sediment toxicity and the Logistic Regression Method for predicting benthic toxicity. This information was used to identify areas posing risk to the benthic community and to identify areas where additional sediment toxicity testing is required to complete the ecological risk assessment and areas where additional sediment chemistry are needed to delineate the lateral extent of contamination. Supporting information is provided in Attachment 1 which includes the rationale for our data evaluation, a summary table and a series of maps depicting the location of sediment sampling stations.

Biota Tissue Data Quality Objectives: EPA has developed a set of Data Quality Objectives (DQOs) for food web model (FWM) biota tissue needs and for refining uncertainties in contaminants of interest (COI) tissue concentrations in order to ensure that the full range of contaminant sources are captured in the tissue sampling. Supporting information is provided in Attachment 2 which includes DQO tables and a biota tissue collection summary table. Regarding the sampling necessary to support the human health risk assessment, further discussion is required to determine the need for whole body tissue samples vs. filet tissue samples for carp, smallmouth bass and black crappie. It should be noted that EPA has not recommended the collection of upstream biota tissue. EPA does not believe this information is necessary to support a remedial action decision at the Portland Harbor site. EPA cautions the LWG against using the upstream tissue data in this manner. If the LWG believes that upstream tissue data are necessary to support a remedial action decision, further discussion between EPA and the LWG will be required to determine whether this is appropriate and, if appropriate, design and implement an approvable upstream sampling plan for this purpose.

Framework for Evaluation Transition Zone Water Data: EPA has developed a framework for the evaluation of transition zone water (TZW) data. This framework is provided in Attachment 3. Based on this framework EPA has determined that additional TZW sampling is required at four specific facilities (Premier Edible Oils, Willbridge, Rhone Poulenc and Gunderson), to support contaminant loading evaluations as part of the contaminant fate and transport evaluation and to support capping scenarios in the feasibility study.

Round 3B Field Sampling Plans: The LWG recently submitted three Round 3B Field Sampling Plans (FSPs):

1. The Round 3B Field Sampling Plan: Sediment Sampling and Benthic Toxicity Testing, dated May 4, 2007;
2. The Upriver and Multnomah Channel Sediment Evaluation and Field Sampling Technical Approach, dated May 21, 2007; and
3. The Round 3B Surface and Sediment Core FSP Preliminary Technical Memorandum dated May 21, 2007.

Although EPA has developed a plan for collecting additional data to support the evaluation of risks to the benthic community and to evaluate the lateral extent of sediment contamination on an initial area of potential concern (iAOPC) basis, EPA has not completed its review of the proposed sediment coring program, the proposed upstream sediment sampling program and the proposed Multnomah Channel sediment sampling program and will be providing specific comments on these FSPs at a later date. In addition, EPA's evaluation of the lateral extent of contamination is limited to benthic risk and does not consider sampling necessary to determine the lateral extent of contamination of areas with elevated levels of bioaccumulative chemicals that may pose risk on a site-wide basis. A summary of each of these elements is provided below:

1. *Upriver Sampling*: The LWG has proposed the collection of sediment samples in 12 upstream areas located between RM 15 and RM 26. The LWG recommends the collection of 3 – 4 samples for grain size analysis and based on the results of the grain size analysis, select up to 20 samples for chemical analysis. Although EPA is generally supportive of this approach, EPA would like to perform additional statistical analysis to ensure that an adequate upstream sample size will be collected. It should be noted that EPA will be performing sediment sampling in the vicinity of Oregon City as part of a Site Investigation targeting the Blue Heron and West Lynn paper mills this summer. Data collected as part of this effort that is located away from known sources of contamination (i.e., the paper mills themselves) may be used to supplement the upstream sediment data evaluation.

2. *Multnomah Channel Sampling*: The LWG has proposed the collection of 10 samples within the upper reaches of Multnomah Channel. Although EPA has not reviewed the FSP in sufficient detail to determine whether the proposed sampling locations are acceptable, EPA does believe that the proposed scale and geographic scope are adequate to characterize the upper reaches of Multnomah Channel.

3. *Sediment Cores*: The LWG has proposed the collection of 30 sediment cores for the purpose of delineating the vertical extent of contamination. EPA understands that additional information will be submitted to support the sediment core proposal. As a result, EPA is not in a position at this time to determine whether the proposed sediment coring program is sufficient to evaluate the vertical extent of contamination. However, it should be noted that EPA proposed 63 sediment cores in our February 17, 2006 Round 3 Scope of Work.

4. *Lateral Extent of Contamination*: EPA has identified a number of areas where additional sediment sampling may be required to delineate the lateral extent of contamination unrelated to benthic risk. This evaluation was based on a comparison to screening criteria presented in "Guidelines for Assessing Bioaccumulative Chemicals of Concern in Sediments" develop by the Oregon Department of Environmental Quality and the 10^{-5} risk level sediment PRG for PAHs presented in Table 10.3-6 of the Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report.

   - PCBs: PCBs have been identified in sediments at concentrations that exceed 48 ug/kg (representing a 10-3 risk level based on the DEQ Bioaccumulative guidance) in the navigation channel in the vicinity of RM 10.4 and along the east bank of the Willamette River between RM 10 and 11.5 Although EPA has proposed additional near shore sediment sampling between RM 10.2 and 10.7 and in the navigation channel in the vicinity of RM 10.6 for the purpose of assessing benthic risk (See Attachment 1) and the LWG has proposed two samples in area 27, additional sampling may be required to delineate the extent of PCB contamination in this area.
   - DDT – DDT has been identified in sediments at concentrations that exceed 40 ug/kg (representing a 10^{-3} risk level based on the DEQ Bioaccumulative guidance) along the west side of the Willamette River between Arkema and Multnomah Channel. Although some of these detections are areas that have been identified for sampling to address benthic risk, a number of areas have not. As a result, additional sampling to characterize DDT contamination may be required off shore of the following areas: PGE, LOFTG, downstream of Kinder Morgan, Babcock and Marine Finance (LWG Area 8).
   - PAHs –Benzo(a)pyrene contamination has been detected downstream of the GASCO facility on the west side of the Willamette River and downstream of McCormick and Baxter and Terminal 4 on the east side of the river above the 10^{-5} risk level sediment PRG presented in the Comprehensive Round 2 Report (170 ug/kg). Additional sampling to characterize PAH contamination downstream of GASCO may be required.
   - Dioxin - Elevated dioxins (i.e. greater than 1.1 ng/kg) seem to be associated with the following sources - U.S. Moorings, Arkema, RPAC, Gunderson and McCormick and Baxter. These sources are generally in areas with benthic risk and do not require additional sampling specifically to address dioxin contamination.

NOT GASCO?

5. *Target Analyte List*: The FSPs attempt to limit the number of analytes that should be analyzed for. However, in many cases, EPA does not agree with the COI identification process as presented in the Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report. For example, at iAOPC 1, the LWG identified PCBs an iCOC and zinc and di-n-butyl phthalate as potential iCOCs. However, chemicals such as chromium, lead and PAHs also exceed screening levels within this iAOPC. As a result, the target analyte list should consider chemicals that were screened in as chemicals of potential concern (COPCs) based on the screening level ecological and human health risk assessments. Chemical groups that screened in for each media are presented in Table 2.

This list should be used as the basis for selecting analytes for each media. Further discussion between EPA and the LWG is required to determine when to perform PCB congeners vs. PCB Aroclors and the need for polybrominated biphenyl ether (PBDE) analysis.

Additional Data Collection based on an Evaluation of Round 3A Data: Round 3A data collection efforts focused on upstream and downstream sediments, surface water, lamprey ammocoetes, pre-breeding sturgeon, and sediment traps. Because the Round 3A data has not yet been submitted, EPA has not reviewed this data to determine whether additional data collection activities. However, EPA has identified three areas where additional data collection may be required:

1. *Lamprey Ammocoetes*: The Round 3A lamprey ammocoete sampling effort was designed to achieve the following objectives:
   - Obtain site-specific empirical lamprey ammocoete whole-body tissue
   - Measure concentrations of constituents in lamprey ammocoetes from the Study Area for use in evaluating risk from hazardous substances to out-migrating lamprey larvae.
   - Collect incidental information on lamprey habitat preference based on catch success.

   Due the limited number of lamprey ammocoetes collected from within the Portland Harbor study areas, it is unclear wither the second objective was met. As a result, additional sampling to ensure that lamprey ammocoetes can be properly assessed may be required pending a review of the Round 3B lamprey tissue data and the results of the Phase 2 definitive toxicity testing program.

2. *Upstream Sediment Sampling*: The Round 3A upstream sediment sampling focused on sediment cores collected off shore of two facilities that are potential sources of sediment contamination: Cargill located at River Mile (RM) 11. 5 on the west side of the Willamette River and the historic Manufactured Gap Plant facility located at RM 12 on the east side of the Willamette River. Although this data was recently received, EPA has not had time to review the data. If the sampling results indicate that either of these facilities represent a significant source of sediment contamination, further discussion between EPA and the LWG will be required to determine if these facilities should be included as part of the Portland Harbor RI/FS and whether any additional data collection activities are required.

3. *Surface Water Sampling*: The Round 3A surface water sampling included additional transects at RM 2 and 16 and near the entrance to Multnomah Channel. In addition, sampling was designed to look at the impact of stormwater discharges on water quality within the Portland Harbor Study area. Because the stormwater sampling and hybrid model for evaluating contaminant fate and transport have not been completed, EPA cannot conclude that additional surface water sampling will be required. In addition, surface water sampling may also be required to assist in the evaluation of groundwater discharges on the surface water quality or in conjunction with upstream sampling for determining background.

Other Potential Sampling Activities: There are a number of potential data collection efforts that have been contemplated by the LWG or EPA that are not identified above. These include the following:

1. *PAH source characterization*: Further evaluation of the source of PAH contamination may prove useful for evaluating bioavailability and for source identification
2. *Treatability studies*: Treatability studies may be required based on the results of the treatment technologies scoping memo.
3. *Side Scan Sonar and other debris identification techniques:* Debris identification may be required to support the FS.
4. *Riparian soil*: EPA has determined that this is an upland data gap to be collected for the purpose of source control evaluations and support terrestrial risk assessments performed at upland sites.
5. *Groundwater Seeps*: EPA has determined that this is an upland data gap to be collected for the purpose of source control evaluations.
6. *Bird Eggs*: Osprey eggs collected from the Lower Willamette River have been analyzed by the USGS. This information is expected to be available in October 2007. EPA will review this information to determine if chemical concentrations in eggs exceed estimated TRVs for osprey, to validate the risk model used to assess risk to fish-eating birds in the risk assessment, and to obtain biomagnification factors which can be used to obtain target tissue levels of contaminants in fish that will be protective of fish-eating birds. A review of this information may identify additional sampling of up 10 osprey eggs to support this evaluation.

As you are aware, we are scheduled to discuss these data gaps on June 14, 2007. EPA looks forward to discussing these data gaps and mapping out an approach for completing the characterization phase of the Portland Harbor RI/FS. If you have any questions in the meantime, please contact Chip Humphrey at (503) 326-2678 or Eric Blischke (503) 326-4006. All legal inquiries should be directed to Lori Cora at (206) 553-1115.

Sincerely,

Chip Humphrey
Eric Blischke
Remedial Project Managers

cc: Greg Ulirsch, ATSDR
Rob Neely, NOAA
Ted Buerger, US Fish and Wildlife Service
Preston Sleeger, Department of Interior
Jim Anderson, DEQ
Kurt Burkholder, Oregon DOJ
Rick Keppler, Oregon Department of Fish and Wildlife
Kathryn Toepel, Oregon Public Health Branch
Jeff Baker, Confederated Tribes of Grand Ronde
Tom Downey, Confederated Tribes of Siletz
Audie Huber, Confederated Tribes of Umatilla
Brian Cunninghame, Confederated Tribes of Warm Springs
Erin Madden, Nez Perce Tribe
Rose Longoria, Confederated Tribes of Yakama Nation
Valerie Lee, Environment International

Tables and Attachments:

Table 1 Round 3 Data Gap Summary

Table 2 Analyte List

Attachment 1 – Benthic Risk Data Evaluation
- Tech Memo – NOAA Integration of Lines of Evidence for Benthic Risk
- Benthic Risk Data Gaps Evaluation Process
- Proposed Surface Sediment and Bioassay Summary Table
- Proposed Surface Sediment and Bioassay Location Map

Attachment 2 – Biota DQOs
- Table 2A – Food Web Model Biota Tissue Data Needs
- Table 2B – COI Tissue Data Needs
- Tissue Summary Table

Attachment 3 – Transition Zone Water Framework

Table 1
Round 3 Data Gap Summary Table

Data Needs	Round	LWG Proposed Samples	Additional Data Needs
Site Wide Data Needs			
Upstream Site Boundary	3A	8 sediment cores and 3 radioisotope cores	Contingent on results of Round 3A.
Downstream Site Boundary	3A	12 grab samples and 7 sediment cores	Additional data collection unlikely.
Riparian Soil	NA	None proposed	None - upland data gap.
Multnomah Channel	3B	10 sediment samples based on bathymetric survey results	General scope and scale of LWG proposal is acceptable.
Non-AOPC Subsurface Sediments	3B	Contingent on additional data evaluation	Unknown.
Upstream - Background	3B	Approximately 20 sediment samples	General scope and scale is acceptable. Finalize sample numbers based on statistical analysis. Supplement with pulp mill site investigation data.
Upstream Surface Water	3A	Transects at RM 16 and 11	Contingent on results of Round 3A.
Upstream Biota	NA	None proposed	Upstream biota not required at this time.
HHRA			
Tissue chemistry	NA	None proposed	Biota tissue required to ensure adequate spatial coverage and full range of contaminant concentrations. Species list includes smallmouth bass (30 - 40 composites), black crappie (12 - 18 composites), carp (12 composites) clams (10 composites) and crayfish (9 composites).
ERA			
Lamprey Ammocoete Tissue	3A	5 ammocoetes and 3 macrothalmia	Contingent on results of Round 3A.
Lamprey Ammocoete Toxicity	3A	Rangefinding and definitive toxicity testing	Definitive toxicity testing proceeding as part of Round 3A.
Pre-Breeding Sturgeon	3A	15 individual fish	Additional data collection unlikely.
Tissue chemistry	3B	None Proposed	Biota tissue required to ensure adequate spatial coverage and full range of contaminant concentrations. Species list includes smallmouth bass (30 - 40 composites), black crappie (12 - 18 composites), carp (12 composites), clams (10 composites), crayfish (9 composites) and sculpin (17 composites).
Sediment Bioassays	3B	12 Bioassays in upper end of study area	44 bioassays recommended to support ERA.
TPH/PAH Evaluation for Bioavailability	3B	TBD	TBD
Bird Eggs	NA	TBD	TBD based on review of USGS osprey egg data.
Fate and Transport Analysis			
Sediment Trap	3A	12 Sediment Trap locations	Additional data collection unlikely.
Stormwater Loading	3A	30 Stormwater sample locations	Additional data collection unlikely as part of Portland Harbor RI/FS. Additional sampling may be conducted as part of source control efforts.
Surface Water Loading	3A	23 Surface Water Samples	TBD based on results of hybrid fate and transport model.
TZW Loading Risk?	3B	None proposed ?	Additional TZW sampling based on review of fate and transport and loading evaluation is required.

Table 1
Round 3 Data Gap Summary Table

Data Needs	Round	LWG Proposed Samples	Additional Data Needs
Food Web Model			
Surface Water	3A	23 Surface Water Samples	Additional data collection unlikely.
Tissue chemistry	3B	None Proposed	Biota tissue required to support food web model or for enhanced understanding of bioaccumulative relationships. Species list includes smallmouth bass (30 - 40 composites), black crappie (12 - 18 composites), clams (10 composites) and sculpin (17 composites).
Feasibility Study			
Treatability Studies	3B	TBD based on results of treatment technologies literature review	TBD
Debris Identification	3B	Side scan sonar on each AOPC	TBD
TPH/PAH Evaluation for Source ID	3B	TBD	TBD
Upstream Tissue Chemistry	NA	None proposed	Upstream biota not required at this time.
Site Wide AOPC			
Sediment chemistry	3B	None proposed	Additional sediment data to ensure adequate site coverage may be required.
Tissue chemistry	3B	None proposed	Additional tissue chemistry likely required to support food web model or for enhanced understanding of bioaccumulative relationships.
Surface Water	NA	None proposed	Additional data collection unlikely.
Transition Zone Water	3B	None proposed	Additional TZW sampling based on review of fate and transport and loading evaluation is required.
AOPC Specific Data Needs			
Surface Sediment Chemistry	3B	49 surface grabs and 30 sediment cores (0 - 6" interval)	136 additional surface sediment samples required to ensure adequate spatial coverage.
Subsurface Sediment Chemistry	3B	30 sediment cores	Additional subsurface sediment likely to determine vertical extent of contamination.
Transition Zone Water	3B	None proposed	Additional TZW required at Willbridge, PEO, Rhone Poulenc and Gunderson.
Groundwater Seeps	NA	None proposed	None - upland data gap.
Surface Sediment Toxicity	3B	12 bioassays proposed.	44 additional bioassays recommended to support ERA.

How about analysis for Concentration that can cannot be left due to mobilization

to where are we going focus on FS?

Table 2
Round 3B Analyte List

	SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT				SCREENING LEVEL HUMAN HEALTH RISK ASSESSMENT			
Chemical Group	**Sediment**	**Surface Water**	**Tissue**	**Transition Zone Water**	**Sediment**	**Surface Water**	**Tissue**	**Transition Zone Water**
Metals	X	X	X	X	X	X	X	X
TBT	X		X	X[1]				
PAHs	X	X	X	X	X	X	X[2]	X
Phthalates	X		X				X	
SVOCs				X			X	X
TPH	X							
Phenols	X	X					X	
PCBs[3]	X	X	X		X		X	X
Dioxins and Furans					X	X	X	X
Pesticides	X	X	X	X			X	X
Herbicides				X				
VOCs				X			X[4]	X
Conventionals	X			X[5]		X[6]		X[7]

[1] TBT typically analyzed in porewater
[2] PAHs included due to elevated detection limits
[3] Aroclor vs. congers TBD
[4] To confirm absence/presences of VOCs in selected areas
[5] Perchlorate and cyanideZx
[6] Perchlorate
[7] Perchlorate and cyanide

Attachment 1A
Portland Harbor Superfund Site
NOAA integration of Lines of Evidence for Benthic Risk
March 22, 2007

Objective:
NOAA has created a scaled and spatially explicit framework for evaluating risk to benthic invertebrates in the Portland Harbor Superfund site based on sediment bioassay testing and 2 predictive models. NOAA is integrating the *Floating Percentile Model (FPM)*, the *Logistic Regression Model (LRM)* and *sediment bioassay data (Hyalella azteca & Chironomus tentans)* in a spatial framework to identify potential areas that may pose risk to benthic organisms and provide a context to identify data gaps within Round 3B and the RI/FS process.

NOAA has created a gridded cell representation of the Lower Willamette River from river mile 1 to 11, which captures the Initial Study Area (ISA) and a portion upstream and downstream. This representation of the river uses a +13 NAVD88 shoreline (source: LWG Comp. Rd. 2 Data Report) and integrates data at a spatially meaningful scale. The grid cells are roughly 0.4 acres each and are intended to provide fairly uniform building blocks to evaluate:

- The presence of data
- The absence of data
- Multiple indicators/measurements of risk to benthic organisms

The 2 predictive models (FPM & LRM) have been scaled to represent the potential for toxicity based on the surface sediment chemistry suite analyzed at a station location. More information on the calculation and interpretation of the LRM can be found in several documents including [1]Field et al 2002 and the [2]LWG Benthic Interpretive Report; more information on the FPM can be found in the Benthic Interpretive Report (Windward 2006).

The Logistic Regression Model calculates a probability of toxicity- Pr_{max} based on the surface sediment chemistry. The Floating Percentile Model essentially develops SQV's for a selected set of chemicals based on the floating percentiles intended to minimize false positives and negatives.

Methods:
The predictive models and the sediment bioassay data have been scaled based on the following criteria:

Logistic Regression Model

Logistic Regression Model	prmax<0.4	prmax>=0.4 and prmax<0.61[a]	prmax>=0.4 and prmax<0.61 and count gt40>1	prmax>=0.61	if count PrMax > .61 > 1[b]
LRM	0	1	2	3	+1 to score

[1] Field et al, 2002. Predicting Amphipod Toxicity from Sediment Chemistry Using Logistic Regression Models. *Envir.Toxicol. Chem. 21:1993-2005.*
[2] Windward et al, 2006. PORTLAND HARBOR SUPERFUND SITE ECOLOGICAL RISK ASSESSMENT: Interpretive Report: Estimating Risk To Benthic Organisms Using Predictive Models Based On Sediment Toxicity Tests. Draft March 17, 2006. Accessed LWG Portal.

Attachment 1A
Portland Harbor Superfund Site
NOAA integration of Lines of Evidence for Benthic Risk
March 22, 2007

Floating Percentile Model

Floating Percentile Model	q80max<1	q80max>=1 and q70max<1	q70max>=1 and q80max >=1	if count q80max > 1[c]
FPM	0	2	3	+1 to score

For the sediment bioassay data, the control-adjusted response for growth & survival has been scaled based on the following criteria:

Sediment Bioassay	Effects Level 0	Effects Level 1	Effects Level 2	Effects Level3
HY28 [d]	0	1	2	3
CH10 [d]	0	1	2	3
ctrl-adj. response	> 90%	80-90%	70-80%	< 70%

Notes on scaling methodology

a For LRM, if more than one analyte per station has .41 < PrMax < .61 but # chemicals > .41 is > 1 then +1 is added to the score

b For LRM, if more than one analyte per station has a PrMax > .61 then +1 is added to the score

c For FPM, if more than one analyte per station has a q80>1 then +1 is added to the score

d HY28 & CH10 are for control adjusted response (Growth and Survival endpoints)- the most severe response for either test/endpoint was used

The highest score from these 3 indicators of benthic risk were summarized based on the grid cell that contains the station(s) location. The maximum score for each line of evidence was used for cases where multiple samples were in the same grid cell. These lines of evidence are represented as shaded grid cells with the following designation of potential benthic risk:

Score	Potential Benthic Risk
No Data	**No Data**
0	**Not Likely**
1	**Low**
2	**Medium**
3	**High**
4	**Very High**

Mapping:
The **1st map series** contains spatial data layers representing surface sediment bioassay data, predictive models summarized by grid cells, LWG iAOPC's identified as benthic risk and base spatial data layers.

Attachment 1A
Portland Harbor Superfund Site
NOAA integration of Lines of Evidence for Benthic Risk
March 22, 2007

The **2nd map series** contains spatial data layers representing the potential benthic risk lines of evidence summarized by grid cells, surface sediment bioassay data, all station locations containing surface sediment used in the predictive models, LWG iAOPC's identified as benthic risk and base spatial data layers.

The **3rd** map series aggregates grid cells into areas of potential concern based on the presence of grid cells scored as high risk. These Areas Of Potential Concern can be further refined to establish data gaps and support decision making. Additionally, all input data from the lines of evidence is captured in this spatially based grid cell approach which can facilitate detailed summary and investigation.

Attachment 1B
Benthic Risk Data Gaps Evaluation Process

Objective:
Use three lines of evidence (LOEs) for assessing benthic risk (floating percentile method, logistic regression method and bioassay results) in conjunction with a weighting framework to evaluate benthic risk data (Round 3 data gap planning)

Question: Is there sufficient data to assess benthic risk?

If not enough data to adequately assess benthic risk then rationale for data needed (data gaps) is addressed in criteria

Criteria for evaluating benthic risk LOE's: bioassay/sediment

1. Lack of spatial coverage; not enough data collected to evaluate adequacy of benthic risk evaluation.
2. Extent of risk not bounded.
3. Comparison of LOEs (predictive models and bioassay data)
    A. Lack of concordance between predicted (models) and measured Toxicity (bioassay)
    B. Lack of concordance between predicted models and insufficient toxicity data (bioassay)
    C. Concordance between models and insufficient toxicity

Course of Action:
1. No Action
    - Area with data (predictive model or bioassay) not targeted for Round 3B data collection
2. Potential Data Gap
    - Area identified as requiring additional data collection for adequate characterization based on above Criteria
3. Area of Interest
    - Area identified as Potential Benthic Risk not requiring additional bioassay or surface sediment sampling Round 3B

Based on this evaluation, two types of data gaps were identified:

1. In areas where the LOEs did not agree, additional bioassays were recommended to support the benthic risk component of the baseline risk assessment. This resulted in the identification of 44 additional bioassay samples.
2. In areas where the risks were not well bounded or there was inadequate sediment chemistry spatial coverage, additional sediment chemistry samples were recommended to delineate the lateral extent of benthic risk. This resulted in the identification of 136 additional sediment chemistry samples.

Attachment 1C
Benthic Risk Sediment Data Summary

EPA Area	Sediment Chemistry	Sediment Bioassays	LWG iAOPC	LWG Proposed Sediment Bioassay	LWG Proposed Surface Sediment	LWG Proposed Sediment Core	Notes
2A	None Required	None Required					
2B	None Required	None Required					
2C	7	None Required	1		4	2	Off-Shore bounding
2D	None Required	None Required					
2E	2	None Required	2		1	0	Off-Shore bounding
2F	None Required	None Required					
3A Downstream	3	3					Off-Shore bounding; bioassays for model concordance
3A Upstream	4	None Required	4 and 5		6	0	Off-Shore bounding; bioassays for model concordance
3B	None Required	None Required	3		0	0	International Slip will be carried forward into FS as a whole
3C	1	None Required					
4A	None Required	2					bioassays for model concordance
4B	8	2					May be addressed through T4 early action
4C	3	None Required					Off-Shore bounding
4D	None Required	None Required					
4E	None Required	None Required	6			1	
4F	None Required	None Required					
5A	None Required	None Required					
5B	None Required	None Required					
5C	None Required	None Required					
5D	1	2					Off-Shore bounding; bioassays for model concordance
5E	2	None Required					Off-Shore bounding
5F	4	1	7		3	2	Off-Shore bounding; bioassays for model concordance
5G	4	None Required	8		0	1	Lateral extent of contamination in navigation channel
5H	2	1	9		0	0	Off-Shore bounding; bioassays for model concordance
5I	None Required	None Required					
5J	3	None Required					Lateral extent of contamination in navigation channel
5K	None Required	None Required	10				
6A	3	3					Link to 6E and 6B
6B	2	2					Link to 6A and 6E
6C	2	None Required	10		3	1	Off-Shore bounding
6D	None Required	None Required					
6E	1	None Required	11		4	2	Link to 6A and 6B
6F	None Required	None Required					
6G	1	1					Link 6G and 6H
NA	None Required	None Required	12		3	0	Center Channel downstream of RR Bridge
6H	1	3	13		3	2	Off-Shore bounding; bioassays for model concordance
6JA	5	None Required	14				Link to 6JB
6JB	10	None Required	14		3	2	May be addressed through Arkema early action
7AA	4	3					McCormick and Baxter Sediment Biosassays not considered
7AB	None Required	None Required	15		2	2	
7B	4	3	16		2	2	Off-shore and upstream bounding; bioassays for model concordance
7C	None Required	None Required					
7D	None Required	None Required					Combine with 7B (Triangle Park)
7E	None Required	None Required					

Attachment 1C
Benthic Risk Sediment Data Summary

EPA Area	Sediment Chemistry	Sediment Bioassays	LWG iAOPC	LWG Proposed Sediment Bioassay	LWG Proposed Surface Sediment	LWG Proposed Sediment Core	Notes
7F	2	3	17		3	2	Off-Shore bounding; bioassays for model concordance
7G	None Required	None Required					
7H	None Required	None Required					
Lagoon	None Required	None Required	22 and 23			3	Swan Island Lagoon will be carried into FS as a whole
8B	5	1	21		0	0	Downstream extent and bioassays for model concordance
8C	1	2					Downstream extent and bioassays for model concordance
8D	None Required	None Required					
8E	None Required	None Required					
8F	None Required	None Required					
8G	4	LWG Proposed	18	3	2	1	Off-Shore bounding
8H	None Required	None Required					
8I	None Required	None Required					
8J	1	None Required					1 Chemistry to link 8K and 8J
8K	1	None Required					Link 8K with 8M; one chemistry downtream
8L	None Required	None Required					
8M	4	LWG Proposed	19	2	3	2	Off-Shore bounding; link with 8K
9A	2	None Required	20		2	1	Chemistry for PCB delineation
9B	2	LWG Proposed		3			Off-Shore bounding
9C	2	1	24		1	1	Off-Shore bounding; bioassays for model concordance
9D	4	3	25		1	1	Off-Shore bounding; bioassays for model concordance
10A	2	None Required	26		2	1	
10B	3	2					Off-Shore bounding; bioassays for model concordance
10C	3	None Required					Off-Shore bounding
10D	5	LWG Proposed		2			Off-Shore bounding
10E	7	None Required					Lateral extent of contamination in navigation channel
10F	4	LWG Proposed		1			Off-Shore bounding
10G	None Required	LWG Proposed		1			
10H	None Required	None Required					
10I	None Required	None Required					
10J	None Required	None Required					
10K	4	3					Off-Shore bounding; bioassays for model concordance
NA	None Required	None Required	27		1	1	PCB area
11A	3	3					Off-Shore bounding; bioassays for model concordance
Total	136	44		12	49	30	

LWG Proposed - LWG proposed bioassays. Further discussion required.
NA - Not applicalble; iAOPC identified by LWG but not by EPA
None Required - EPA does not require additional sampling for purpose of assessing benthic risk

Attachment 2A – Process for evaluating Biota Tissue DQOs: Food web model (FWM) Validation Biota Tissue Needs

DQO Step	Output
1. State the problem	A food web model validation data set does not exist. FWM validation is the comparison of model output to observed data for a dataset that was not included in the calibration of the model. The site-wide FWM has been calibrated using all available biota samples, which are limited in number (n = 6 to 26 for fish, depending on species), and which do not provide full spatial coverage of the ISA in some instances. In other instances (e.g., smallmouth bass) the existing tissue data were not composited in a manner consistent with the known movements of the species collected within the harbor. To confirm the utility, ability and accuracy of the FWM to meet its objectives, additional fish and shellfish samples must be obtained.
2. Identify decision(s) to be made	The immediate decision to be made is definition of the species, number and locations of samples for each species that must be collected from within the ISA. Within the context of the Portland Harbor RI/FS, a determination will be made regarding whether or not the food web model has sufficient accuracy and has be adequately validated to permit its use to derive preliminary remedial goals (PRGs) for selected chemicals in sediment. Two possible outcomes are possible from this decision. 1) The food web model is sufficiently accurate and has been adequately validated to permit its use in PRG development, or 2) The food web model is not sufficiently accurate or has not been adequately validated to permit its use in PRG development. The outcome from option 1 above is the use of the food web model to develop PRGs for selected chemicals. The outcomes from option 2 above will be to either use another method to develop PRGs, or to obtain additional tissue data in an effort to validate the food web model.
3. Identify inputs to the decision	Existing Round 1 and Round 2 biota tissue concentrations and sample locations will be used as the basis for determining Round 3 biota DQOs and sample design. This information includes the species to be collected, the number and type (individual organism or composite samples) of samples of each species, and the locations of each species to be sampled within the ISA.

DQO Step	Output
	Species to be collected for food web model (FWM) validation are the following: - smallmouth bass - sculpin (likely multiple species within the ISA, mixed species sculpin samples are acceptable for the FWM) - black crappie - clams/mussels (likely multiple species within the ISA, mixed species clam/mussel samples are acceptable for the FWM)
4. Define the boundaries	The geographic boundaries for upstream biota tissue samples should extend from river mile (RM) 0.5 to RM 12, the boundaries of the Portland Harbor Study Area.
5. Develop a decision rule	1) To ensure that the validation data set is comparable to the calibration dataset, collect a sufficient number of samples to provide a data set that is comparable in size to or larger than that of the FWM calibration data set. Existing samples sizes within the ISA include N = 6 crappie, N = 14 for smallmouth bass, N = 26 for sculpin, and N = 36 for *Corbicula* clams (field-collected). 2) To ensure that the validation data set is representative, sample placement throughout the Study Area should ensure adequate coverage of most/all significant sources of COI exposure to aquatic biota. Scale of this coverage should be dependent on the home or foraging range of each species to be collected. Species-specific considerations for this decision rule include: ▪ Bass should be collected independently from each side of the river, with 1 composite adult bass sample collected from within each river mile. ▪ Black Crappie should be collected on a river mile basis. 1 composite sample of crappie should be taken from each river mile. Crappie samples can be composited from bank to bank if needed. ▪ Sculpin crayfish and clam locations should be placed to ensure that the full range of contaminant concentrations within the ISA are sampled. It is estimated that the following sample numbers will be required: Sculpin: 17, and clams: 10. 3) The data to be collected should also be sufficient to serve as the baseline (T = 0) data set for the dynamic food web model for the site.
6. Specify tolerable limits	As the objective is to obtain biota samples for validation of the food web model, no formal or statistical

DQO Step	Output
on decision errors	tolerance limits are needed on the analytical results of the sample analyses. At a minimum, the same number of fish samples for the selected species used to calibrate the food web model should be collected from throughout the ISA to permit FWM validation. The FWM model itself should at a minimum predict all measured chemical concentrations in biota tissue within the previously agreed to 10x level of accuracy. A desired goal is to have accuracy within 5x of measured tissue residues for all species modeled.
7. Optimize the design	The sampling locations should be selected with both the distribution of sediment contaminants and fish habitat and movement in mind. Final decisions will be made by Eric Blischke, with input from Burt Shephard, Bruce Hope and Larry Burkhard. This will also require discussions with fisheries biologists familiar with the Willamette River fish stocks within the ISA.

Attachment 2B – Process for evaluating Biota Tissue DQOs: Reduce uncertainties in contaminant of interest tissue (COIs) concentrations in support of the human health and ecological risk assessments.

DQO Step	Output
1. State the problem	Biota tissue samples collected during Round 1 and Round 2 of the Portland Harbor RI/FS do not capture all potential contaminant of interest (COI) sources. The existing data set is limited in number (N = 6 to 36 in fish and shellfish depending on species) and in spatial coverage (for example, the black crappie whole body composite samples were collected in the vicinity of Terminal 4 and the Portland Shipyard). As a result, it is unclear whether the full range of COI concentrations potentially encountered by ecological and human receptors in Portland Harbor are reflected in the existing data set. To ensure a representative data set both to identify sources and to characterize ranges in risk for both ecological receptors and humans, additional fish and shellfish samples must be obtained. As an example, in LWG's 2004 Programmatic Work Plan (Table 7-6), the following decision rule was presented for evaluating risk to fish receptors (non-special status): "If the COPC concentration using the 95th UCL or maximum concentration is greater than the LOEC in the population-level assessment, the COPC will be retained for further evaluation." This decision rule is only effective if all or most key COPC sources have been sampled, particularly for receptors with relatively small ranges/scales such as sculpin, crayfish, or smallmouth bass. EPA believes the existing dataset does not adequately represent all key COPC sources.
2. Identify decision(s) to be made	The immediate decision to be made is definition of the species, number and locations of samples for each species that must be collected from within the ISA. Within the context of the Portland Harbor RI/FS, a determination will be made regarding whether or not the fish tissue data is spatially representative to encompass the full range of COI exposures. This is necessary to ensure that risk calculations adequately represent the full range of potential risks posed by COI exposure. Two possible outcomes are possible from this decision: 1) The fish and invertebrate tissue data are spatially representative and can be used to support the human health and ecological risk assessments, or 2) The fish and invertebrate tissue data are not spatially representative and additional biota tissue is needed to support the human health and ecological risk assessments. The outcome from option 1 above is the use of the existing biota tissue data set to support the human

DQO Step	Output
	health and ecological risk assessments. The outcome from option 2 above is that additional biota tissue data will be need to be collected to support the human health and ecological risk assessments.
3. Identify inputs to the decision	Existing Round 1 and Round 2 biota tissue concentrations and sample locations will be used as the basis for determining Round 3B biota DQOs and sample design. This information includes the species to be collected, the number and type (individual organism or composite samples) of samples of each species, and the locations of each species to be sampled within the ISA. Based on a review of the Round 1 and Round 2 sample locations and tissue concentrations, species to be collected are the following: - smallmouth bass (human health and ecological risk assessment) - sculpin (ecological risk assessment) - clams (human health and ecological risk assessment) - crayfish (human health and ecological risk assessment) - black crappie (human health and ecological risk assessment) - carp (human health and ecological risk assessment)
4. Define the boundaries	The geographic boundaries for biota tissue samples should extend from river mile (RM) 0.5 to RM 12, the boundaries of the Portland Harbor Study Area.
5. Develop a decision rule	Collect a sufficient number of samples to ensure adequate coverage of significant sources of COI exposure to aquatic biota. Scale of this coverage should be dependent on the home or foraging range of each species to be collected. Species-specific considerations for this decision rule include: ▪ Bass should be collected independently from each side of the river, with 1 composite adult bass sample collected from within each river mile with additional samples collected in selected source areas. ▪ Black Crappie should be collected on a river mile basis. 1 composite samples of crappie should be taken from each river mile, with additional samples collected in selected source areas. ▪ Carp composites should be collected on a river reach basis. Three carp composites should be collected from each of 4 river reaches (RM 0 – 3 and Multnomah Channel, RM 3 – 6, RM 6 – 9 and RM 9 – 12) ▪ Sculpin clam and crayfish locations should be placed to ensure that the full range of contaminant concentrations within the ISA are sampled. It is estimated that the following sample numbers will be required: Sculpin: 17; clams: 10; and crayfish: 9.

DQO Step	Output
6. Specify tolerable limits on decision errors	As the objective is to ensure adequate spatial coverage, no statistical tolerance limits are needed on the analytical results of the sample analyses.
7. Optimize the design	Sampling locations should be adjusted accordingly to ensure adequate spatial coverage and to account for the presence of known sources of contamination. Specific locations require further discussion. As a starting point, EPA's February 2006 Round 3 Scope of Work and the PH Round 2 Comprehensive Site Summary and Data Gaps Report suggest the following target locations: ▪ Bass: Additional bass should be collected in the vicinity of specific source areas, particularly within the RM 6 – 8 reach and in off channel areas such as International Slip and Swan Island Lagoon. ▪ Black Crappie: Black Crappie should be targeted for collection in off-channel areas where they are known or suspected to be present. For example, International Slip, Terminal 4, U.S. Moorings, Willamette Cove, Swan Island Lagoon, Willbridge, Gunderson, Fireboat Cove and Terminal 1 Cove. ▪ Clams: Should be collected in areas of PAH contamination and in areas where clams were not collected during Round 2B. These areas include off shore of Terminal 5, Sauvie Island, downstream of GASCO between Multnomah Channel and RM 4.6 (2) and between RM 4.8 and 6.0, downstream of Mar Com near RM 5.5, Sulzer, Cargill, Historic MGP, and the East Bank Esplanade just upstream of the Steel Bridge. ▪ Crayfish: Crayfish should be collected off shore of Terminal 5, Sauvie Island, downstream of GASCO between RM 4.8 and 6.0, GASCO/Siltronic, Gunderson (near Shell dock structure), Sulzer, Cargill, Historic MGP, and the East Bank Esplanade just upstream of the Steel Bridge. ▪ Sculpin: Sculpin should be collected off shore Terminal 5, Sauvie Island, Time/PEO, Linnton Plywood, Mar Com, GASCO/Siltronic, Triangle Park, Swan Island Lagoon (Coast Guard and Fred Devine), Willbridge, Gunderson (2), UPRR/Goldendale, Sulzer, Cargill, Historic MGP, and the East Bank Esplanade just upstream of the Steel Bridge.

Attachment 2C
Biota Tissue Data Gap Summary

Species	Number	Species Rationale	DQO Addressed
Clam Tissue Composite	10	Benthic species for food web model. Key species for human health risk assessment.	Food Web Model and COI uncertainty
Crayfish Tissue Composite	9	Key species for human health risk assessment..	COI uncertainty
Sculpin Tissue Composite	17	Benthivore for food web model.	Food Web Model
Smallmouth Bass Tissue Composite	30 - 40	High trophic level predator for food web model. Key species for human health risk assessment.	Food Web Model and COI uncertainty
Black Crappie Tissue Composite	12 - 18	Water column fish for food web model. Key species for human health risk assessment.	Food Web Model and COI uncertainty
Carp Tissue Composite	12	Key species for human health risk assessment.	COI uncertainty
Total	90 - 106		

ATTACHMENT 3
DATA GAPS FRAMEWORK FOR TRANSITION ZONE WATER

Purpose:

The purpose of the document is to present a framework for evaluating transition zone water (TZW) at the Portland Harbor Superfund Site for the purpose of identifying Round 3B data gaps. This framework builds off previous evaluation frameworks that were described in EPA's comments on the Groundwater Pathway Evaluation Sampling and Analysis Plan (GW SAP) dated June 3, 2005 which included a data quality objectives (DQO) table and a set of DQOs developed by the Lower Willamette Group (LWG) in May 2006.

Current Status:

TZW has been characterized at 9 sites within Portland Harbor. This data was collected in the fall of 2005 and was presented in the Groundwater Pathway Analysis Report dated August 7, 2006 and the Round 2 Data Summary Report dated February 21, 2007. Sites identified for TZW characterization were selected based on exceedance of source control screening criteria in groundwater at the river bank. TZW characterization was focused on areas of contaminated groundwater discharge.

Objectives of TZW Sampling Effort:

The stated goal of the Round 2 Groundwater Pathway Assessment was to "determine whether discharges of groundwater-related chemicals of interest contribute to unacceptable risk to human health or the environment within the Portland Harbor site. Transition zone water was collected and analyzed to quantify concentrations of groundwater-related COIs in areas of plume discharge.

Screening Step:

TZW was screened against:

- Chronic AWQC for the protection of aquatic life
- Fish consumption AWQC for the protection of human health based on a fish consumption rate of 17.5 g/day.
- Safe Drinking Water Act MCLs.
- EPA Region 9 Tap Water PRGs.

The results of this screening step are described in the Round 2 Groundwater Pathway Assessment Transition Zone Water Site Characterization Summary Report dated August 7, 2006.

Risk Framework:

Four risk pathways have been identified for evaluation:

Direct Pathway for Ecological Risk: Benthic organisms can be exposed directly to TZW. In addition, groundwater discharges to surface water can result in water column exposures.

Under the Portland Harbor risk framework, multiple lines of evidence will be considered to determine risk to the benthic community. These LOE include:

- Empirical measurements of benthic toxicity through sediment bioassays
- Application of predictive models that use sediment chemistry to predict whether the sediments are expected to be toxic.
- Comparison of sediment chemistry results to SQGs.
- Benthic Tissue chemistry compared to tissue based TRVs.
- Application of a benthic tissue BSAF and tissue based TRVs to determine potential risks to benthic organisms.
- Comparison of TZW to chronic AWQC.

In areas of contaminated groundwater discharge, some of these lines of evidence may not be applicable. For example, sample handling procedures may cause a loss of volatiles and/or change redox conditions such that bioassays may not accurately measure sediment toxicity and benthic tissue samples may not have been collected or be present in areas of groundwater discharges. As a result, a comparison of TZW to chronic AWQC represents the best line of evidence for assessing risk to benthic organisms from TZW and determining the potential for risks to aquatic life in surface water.

Direct Pathway for Human Health Exposure: Direct human exposure to TZW is not considered a complete exposure pathway. However, contaminated groundwater discharges have the potential to affect surface water where human exposure can occur. As a result, TZW was screened against SDWA MCLs and Region 9 tap water PRGs. However, because SDWA MCLs have not been exceeded in surface water at the site and the only tap water PRGs exceeded were for arsenic, carcinogenic PAHs and dioxin, it is unclear based on this data whether groundwater discharges are impacting the drinking water beneficial water use of the Willamette River.

Indirect Pathway for Ecological Risk: There are no water criteria for evaluating the risks to ecological receptors exposed to TZW contaminants that have been uptaken by aquatic organisms and have entered the food chain. According to EPA's draft guidance on evaluating risks to ecological receptors, four options for assessment of this pathway area available: 1) Analysis of indigenous biota (e.g., clams and crayfish) that may be exposed to TZW; 2) Analysis of organisms placed in areas of contaminated groundwater discharge to measure contaminant uptake (e.g., caged mussels); 3) Analysis of tissue surrogates (e.g., SPMDs) to estimate contaminant uptake; and 4) Application of biota uptake models.

Indirect Pathway for Human Health Risk: Unlike the indirect pathway for ecological risk, human health fish consumption AWQC are available to assess this pathway. Because the Portland Harbor RI/FS has established a shellfish consumption rate of 18 g/day, the fish consumption AWQC (based on 17.5 g/day) may be used directly.

Application of Framework:

Detections of COIs in TZW in areas of plume discharge at concentrations that exceed criteria demonstrate that groundwater COIs are discharging to the Willamette River at concentrations

that may pose a threat to human health and the environment. TZW should be evaluated to assess the risk associated with groundwater discharges and as a line of evidence for evaluating in-water risks associated with contaminated sediments.

AWQCs and MCLs as a Measure of Protectiveness: Application of the framework is based a determination that the chronic AWQC, human health fish consumption AWQC and MCLs are a measure of protectiveness. Comparison of TZW to AWQCs should be performed to determine whether TZW represents a risk to human health and the environment. In addition, a comparison of surface water data to MCLs in the immediate vicinity of the groundwater discharge may also be used to determine whether TZW represents a risk to human health under a drinking water scenario. In areas of contaminated groundwater discharge, a comparison to AWQCs and MCLs will be used to determine whether there is a complete contaminated groundwater pathway from the upland site to the river and assess the risks associated with contaminated groundwater discharges. In addition, the TZW data will be used as one line of evidence for evaluating risks to human health and the environment associated with contaminated sediments. If it is determined that there is a complete groundwater pathway and the design and/or implementation of source control measures are not being taken at the time of the Portland Harbor Record of Decision (ROD), upland groundwater plumes will be considered part of the Portland Harbor site.

Adequacy of Characterization: EPA has determined that the TZW data is generally inadequate to develop representative exposure point concentrations. For example, the density of data is not sufficient to calculate an appropriate average TZW concentration for the purpose of estimating the risk to human consumers of shellfish. In addition, the data does not take into account temporal variability either on a seasonal basis or a tidal cycle basis. In addition, with the exception of the Siltronic site, no surface water data was collected in the vicinity of TZW discharges that could be used to determine whether contaminated groundwater discharges are affecting surface water. As a result, transition zone water should be compared to water quality standards on a sample by sample basis to assess the risk associated with contaminated groundwater discharges and as one line of evidence for assessing in-water risks associated with contaminated sediments. More realistic estimates of risk will require additional characterization to develop an average TZW concentration over a shellfish consumption area or to evaluate the impact of contaminated groundwater discharges on surface water.

Chemicals and Exposure Pathways for Which Applicable Criteria do not Exist: AWQC and MCLs do not exist for all chemicals detected in TZW. In addition, there are no criteria available for evaluating indirect effects on ecological receptors (i.e., consumption of organisms that have been exposed to TZW). However, the Portland Harbor RI/FS includes a comprehensive risk assessment that will identify the chemicals that present risk to human health and the environment. This evaluation will be used to determine what additional actions to address contaminated groundwater sources, if any are necessary to ensure protection of human health and the environment.

Relationship to TZW Data Gaps:

EPA has identified four categories of data gaps. Each data gap and the relationship to the TZW framework is described below:

Identification of New Groundwater Sites: Sites where contaminated groundwater has the potential to impact transition zone water were identified based on a comparison on upland groundwater to Joint Source Control Strategy (JSCS) criteria. At this time, there are only four additional sites or areas within an existing site that meet the criteria for moving forward with TZW sampling:

- *Premier Edible Oils*: The PEO site was identified as a candidate for TZW sampling in 2005. Additional upland work in the form of beach wells was proposed. However this work has not occurred. Unless beach wells are installed that demonstrate that groundwater contaminants are not discharging to the Willamette River, characterization of TZW is required.
- *Willbridge Bulk Fuel Terminal*: The Willbridge Bulk Fuel Terminal site was identified as a candidate for TZW sampling in 2005. Although sampling took place off shore of this facility, this work did not take place offshore of a preferential groundwater discharge pathway that is a known conduit for contaminated groundwater migration. As a result, characterization of TZW off shore of this area is needed to determine the risks posed by contaminated groundwater discharges to the Willamette River.
- *Rhone Poulenc - Deep Groundwater*: EPA and the LWG agreed that characterization of deep groundwater discharges would take place at the RPAC facility. This has not taken place. Unless this work is undertaken by the upland party, EPA will require the LWG to collect this data consistent with the agreements described in your letter dated July 25, 2005.
- *Gunderson Deep Groundwater*: EPA and the LWG agreed that characterization of deep groundwater discharges would take place at the Gunderson facility. This has not taken place. Unless this work is undertaken by the upland party, EPA will require the LWG to collect this data consistent with the agreements described in your letter dated July 25, 2005.
- *Oregon Steel Mill*: Manganese has been detected in groundwater collected from beach wells installed off shore of the OSM site at concentrations that exceed screening levels. However it is unclear whether the detected levels of manganese are contaminant related or represent a background condition. Further evaluation is required to determine whether manganese levels represent natural background conditions. Due to the site specific nature of this evaluation, EPA recommends that this work be undertaken by the upland party.

Additional sites may that meet the criteria for offshore TZW characterization may be identified in the future. EPA expects that this work will be performed by upland parties in accordance with the JSCS. EPA also recommends that the sites identified above also be addressed by upland parties using the techniques and approaches developed by the LWG.

Refinement of Risk Estimates: EPA expects that a determination of the need for source control measures and sediment cleanup activities should be performed on a point by point basis unless additional TZW and/or surface water characterization is performed. The LWG

should determine on a case by case basis whether this work should be performed or the LWG is willing to move forward based on the existing data.

Nature and Extent of Contamination: In areas where it has been determined that TZW associated with contaminated groundwater discharges poses a risk to human health or the environment, any additional characterization necessary for the design and/or implementation of source control measures should be performed by the upland party. Any additional TZW data necessary to support the in-water risk assessment and feasibility study should be collected by the LWG. In-water data necessary to determine the nature and extent of contamination should include both sediment and TZW data.

Contaminant Loading Associated with Groundwater Discharges: The framework described above addresses areas of contaminated groundwater discharges. Because flux measurements and TZW data were collected offshore of these facilities, it is expected that reasonable estimates of contaminant flux associated with groundwater discharges can be obtained with existing data. However, the movement of "clean" groundwater through contaminated sediments may mobilize buried sediment contaminants and transfer them to surface sediment or surface water where exposure may occur. This is a particular concern for bioaccumulative contaminants where low contaminant flux rates over a large area of sediment contamination may represent a significant load to the river system, in localized areas such as Willamette Cove where groundwater transport of buried sediment contamination may contribute to the levels of contaminants seen in biota and surface water and to support capping scenarios to be evaluated in the Portland Harbor feasibility study. This information should be collected by the LWG in conjunction with the contaminant fate and transport evaluation currently underway.